

RECENT TRENDS IN MARINE BIRD MONITORING IN INDIA

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Studies on marine birds of India are scarce and available information is based mainly on wind-blown bird data and a few isolated off-shore trips. An attempt was made in recent years to address this lacuna by conducting off-shore trips from the coasts of Karnataka and Kerala to monitor marine birds. We report the significant results from these studies and demonstrate a simple and sustainable methodology for similar future surveys. The study indicates the presence of a good number of pelagic birds off the south-west coast of India belonging to ten species, including a few significant records for the two states. Comparison with prior wind-blown records suggests a negative correlation for a large number of species indicating that such off-shore surveys are the only way to document the status of pelagic birds in our waters. This study also indicates the presence of both boreal and austral breeders wintering and summering in our region respectively. We highlight the potential threats to marine birds in the Arabian Sea and emphasise the need for such future studies. We summarise the hurdles, improvements, and actions in executing such surveys, potentially involving collaboration of larger regional agencies involved in marine research.

Key words: pelagic birds, bird monitoring, Kerala, Karnataka, shearwaters, storm-petrels, jaegers, boobies

INTRODUCTION

The marine ecosystem in general is one of the less monitored ecosystems in the world – marine studies have largely been concentrated on fish-catch and understanding the oceanographic factors affecting fish resources. Though monitoring of marine birds is almost unheard of in India, detailed methodologies and the relevance of such studies have been documented elsewhere (Walsh *et al.* 1995). Due to this lack of monitoring, the data on Indian marine avifauna is also meagre (Robertson 1995), as apart from isolated boat trips, or expeditions to Lakshadweep (Mathew and Ambedkar 1964; Mohan 1989; Pande *et al.* 2007), this data has been compiled only from wind-blown records (Sashikumar *et al.* 2011). During recent years, regular sea-watching conducted from the Sri Lankan coast has provided interesting records and information (de Silva 1987, 1997). It was therefore felt necessary to conduct similar sea-watching surveys from the Indian coast to collect more information on our marine birds. In general, seabirds are more threatened than many other groups of birds and their status has deteriorated faster than others over the recent decades (Croxall 2012), hence, it is important to study and monitor the status of marine avifauna of the region. Kerala is well-known for co-ordinated bird-surveys to monitor threatened birds of Western Ghats (Praveen and Nameer 2009). So, in the last two years, an attempt was made to harness the same human resources to monitor seabirds as well. As a part of this exercise, a set of ten expeditions (totalling 19 field days, i.e. more than 120 hours) were conducted in the Arabian Sea from seven different points on

the south-west coast from 2010-2012 (between Udupi in Karnataka and Kochi in Kerala) and the results have been encouraging. This paper summarises the preliminary findings from these surveys (Chandran *et al.* 2011; Praveen *et al.* 2011; Shivashankar *et al.* 2011) and proposes a simple, tested field methodology for comparative studies.

METHODOLOGY

The objective was to conduct a survey in every season of the year to understand the pattern of seabird abundance. Hence, trips were conducted in all months of the year except June, August, November, and December, covering winter, pre-monsoon, monsoon, and post-monsoon seasons. The trips were mostly made in fishing boats. Observations were made using binoculars and photographs were taken to help in species identification. All seabirds sighted within an estimated 200 m on either side of the boat were identified to the lowest taxonomic level possible using standard field guides (Harrison 1985, 1996; Rasmussen and Anderton 2005). The surveys were conducted from Malpe (Udupi) (13°20'52" N; 74°42'1" E), Mulki (13°44'46" N; 74°46'25" E) and Mangalore (12°51'30" N; 74°49'56" E) in Karnataka and Azheekkal (Kannur) (11°91'20" N; 75°31'95" E), Chombala (11°56'54" N; 75°59'14" E), Chettuva (10°30'31" N; 76°21'0" E), and Munambam (Kochi) (10°11'2" N; 76°10'25" E) in Kerala (Fig. 1).

The varying abundance patterns of migrant sea-birds in our seas, lack of obvious nesting colonies on the south-west coast of India, nature of the craft available for surveys and the expertise level among birdwatchers in monitoring



Fig. 1: Map of locations of the pelagic surveys

sea-birds influence the design of a feasible and sustainable methodology for monitoring marine birds. During the initial phases of the survey, a simple method requiring minimal effort was used to collect data. Later, a slightly more rigorous methodology was evolved for data collection and analysis.

Pilot Survey Methodology

Some of the seabirds preferred to follow fishing boats whereas others did not. In order to sample birds with both preferences, surveys were planned for two days whenever possible – one day was spent following fishing boats (generally up to 20 km from the shore) and moving parallel to the shore, and the next day was used to go to deeper sea (up to 45 km from the shore). *Chum* (bait) was not used in these surveys. The time, species, and number of birds were noted for each sighting. Using prior knowledge (Ali and Ripley 1987; Sashikumar *et al.* 2011), the index of relative abundance from pilot surveys was compared with the wind-blown records in a scatter-plot to identify if they were correlated.

Intensive Survey Methodology

The intensive surveys during this study were a modification of the methodology used by Bailey (1968). The last four surveys were done using this methodology, which was found adequate for basic analysis of abundance and

distribution, and was feasible and easy to execute. The method helps to identify the preferential distance-bands of different species and compare them across sites and across species.

The area surveyed was logically split into multiple distance bands based on the distance from the coast (0-10 km, 10-20 km, etc.) – bands were determined using GPS. Similarly, the survey time was logically split into multiple time bands (with 30 minute intervals, aligned to hour boundaries).

The data recorded is given below:

- GPS location was collected at a constant interval of 10 minutes from the time when the boat enters the sea till the boat was either anchored (in case of overnight stay) or when it starts its return journey. This can be done with the help of a GPS device or even with a GPS equipped smart phone.
- When birds are sighted, the time, species and count are recorded.

The above data helps to determine:

- Location of sighting (extrapolated from adjacent GPS positions).
- Species-wise distribution across distance and time bands.

- Abundance of various species across distance and time bands.

RESULTS

Ten species of seabirds belonging to five families were recorded during ten expeditions conducted from the west coast of India during 2010-12.

Significant Bird Sightings

Jouanin's Petrel *Bulweria fallax*: About 10 sightings from the coast of Kannur on September 24, 2011. This is the second record from Kerala coast (Sashikumar *et al.* 2011) and probably the tenth within Indian waters (Robertson 1995). The species is considered Near Threatened by IUCN due its restricted distribution and tiny breeding range.

Flesh-footed Shearwater *Puffinus carneipes*: One of the commonest seabirds during May-October with huge congregations, sometimes up to 500 (Chandran *et al.* 2011), were recorded near fishing fleets. Prior to this study, there is only a single record of this species from Kerala (Praveen *et al.* 2011; Sashikumar *et al.* 2011).

Wedge-tailed Shearwater *Puffinus pacificus*: A single bird photographed from the coast of Kannur on May 28, 2011; this was the first record for Kerala (Praveen *et al.* 2011).

Persian Shearwater *Puffinus persicus*: Recorded from Kerala (Praveen *et al.* 2011) and Karnataka coast (Shivashankar *et al.* 2011) during March-April with a maximum flock size of 23 birds on April 05, 2011, from Kannur coast, prior to this study – there has been only one record from Kerala and another from Karnataka.

Wilson's Storm-Petrel *Oceanites oceanicus*: Studies indicate that this species is present in our seas between May-October and is reasonably common from about 40 km off-

shore. Prior to these studies, there have been no sightings of this species from Karnataka and just two reports from the coast of Kerala (Chandran *et al.* 2011; Praveen *et al.* 2011).

Swinhoe's Storm-Petrel *Oceanodroma monorhis*: Recorded from the Indian coast for the first time in July 2011 (Chandran *et al.* 2011). The bird was found to be reasonably common in subsequent surveys in September and October from the Kerala and Karnataka coasts respectively – and was an addition to the bird checklist of both states.

Parasitic Jaeger *Stercorarius parasiticus*: The most common jaeger species recorded during the surveys, most sightings were during September-April. Prior to this study, the species was considered a vagrant to the west coast (Rasmussen and Anderton 2005) with single records from Kerala and Karnataka.

Pomarine Jaeger *Stercorarius pomarinus*: Rasmussen and Anderton (2005) report it to be more common than *S. parasiticus* on the west coast. We, however, recorded it only on March 04, 2012, from the Mangalore coast; this is the first record from the Karnataka coast.

Pilot Survey Results (September 2010 to July 2011)

Based on the species-wise bird counts, abundance of the birds was calculated as average number of birds recorded per hour (Table 1). Bridled Tern *Onychoprion anaethetus*, Flesh-footed Shearwater and Wilson's Storm-Petrel accounted for the maximum number of identified birds.

Comparison of wind-blown species records from the south-west coast of India vis-à-vis the records from the recent pelagic expeditions were plotted on a scatter plot as index of abundance on each axis (Fig. 2). Contrary to our expectations, the abundance level of each species at sea is different from its abundance level in the wind-blown records – and many species show an inverse relation. If the rate of recovery of wind-blown

Table 1: Abundance data for Pilot Surveys of 2010-2011 (in decreasing order of abundance)

Species	No of Birds/hour											
	Sept.	Sept.	Jan.	Jan.	Jan.	Apr.	Apr.	Apr.	Apr.	May	May	Jul.
Flesh-footed Shearwater	62.50	11.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.78	4.71	125.00
Bridled Tern	0.50	11.11	0.00	0.00	0.00	5.26	1.25	28.57	72.22	14.81	8.24	5.00
Wilson's Storm-Petrel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	12.50
Sooty Tern	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.59	8.24	1.88
Persian Shearwater	0.00	0.00	0.00	0.00	0.00	0.32	0.00	3.81	4.44	0.00	0.00	0.00
Parasitic Jaeger	1.88	1.11	0.67	0.33	0.00	0.11	0.38	1.90	1.78	0.00	0.12	0.13
Masked Booby	0.25	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wedge-tailed Shearwater	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00
Swinhoe's Storm-Petrel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13

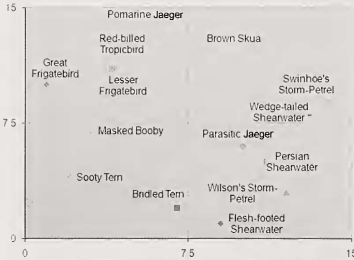


Fig. 2: Scatter plot showing abundance of wind-blown species (X-axis) vs. abundance of species seen from boat (Y-axis)

species and what is seen from the boat are similar, we would have expected more entries in the first quadrant (close to 0). For example, the most common birds according to our surveys were Bridled Tern and Flesh-footed Shearwater, and there are very few wind-blown specimens of both (Fig. 2).

Intensive Survey Results (September 2011 till date)

Based on the total number of birds sighted across the four trips and the total number of hours spent in the field, the abundances of various species observed during different time-bands were plotted as the percentage of time-bands when the bird was observed (Table 2). Since, this is an ongoing study, here we only indicate how this method can be used to compare the results and carefully be generalised by indicating a few special cases.

Case 1: Comparison of relative abundance of Bridled and Sooty Terns (Kannur, September, 2011)

In general, Bridled Terns were much more common than Sooty Terns *Onychoprion fuscatus* at sea – contrary to what the wind-blown records indicate. Comparison of the abundance indicator of both the terns is shown in Fig. 3. Sooty Terns prefer areas further from the coast (about 40 km offshore), while Bridled Terns are found across the entire range from the sea coast till about 90 km.

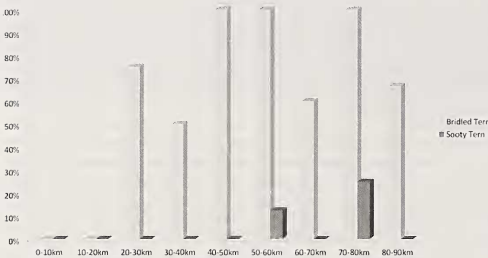


Fig. 3: Comparison of abundance of Bridled and Sooty Terns at Kannur

Case 2: Comparison of relative abundance of Bridled Tern, Wilson's Storm-Petrel and Parasitic Jaeger from Kannur (September 2011) and Udupi (October 2011)

Table 2: Combined abundance data from intensive surveys as % time bands where the species was present

Species	Distance bands (in km) and values expressed as % of total number of time bands								
	0-10	10-20	20-30	30-40	40-50	50-60	60-70	80-90	90-100
Bridled Tern	9.09	50.00	71.43	69.23	78.95	75.00	50.00	100.00	66.67
Sooty Tern	0.00	0.00	0.00	0.00	0.00	6.25	0.00	25.00	0.00
Flesh-footed Shearwater	0.00	0.00	0.00	0.00	5.26	12.50	16.67	25.00	33.33
Persian Shearwater	0.00	0.00	0.00	0.00	5.26	0.00	0.00	0.00	0.00
Jouanin's Petrel	0.00	0.00	0.00	0.00	0.00	6.25	0.00	0.00	100.00
Wilson's Storm-Petrel	0.00	0.00	14.29	0.00	10.53	43.75	100.00	100.00	100.00
Swinhoe's Storm-Petrel	9.09	18.75	21.43	23.08	10.53	25.00	66.67	100.00	66.67
Masked Booby	0.00	6.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Parasitic Jaeger	0.00	43.75	28.57	7.69	47.37	12.50	0.00	25.00	0.00
Pomarine Jaeger	0.00	0.00	0.00	0.00	31.58	0.00	0.00	0.00	0.00

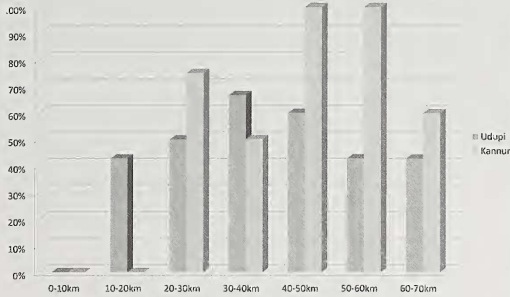


Fig. 4: Comparison of abundance of Bridled Tern between Udupi and Kannur

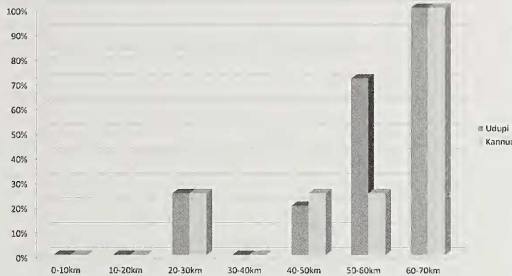


Fig. 5: Comparison of abundance of Wilson's Storm-Petrel between Udupi and Kannur

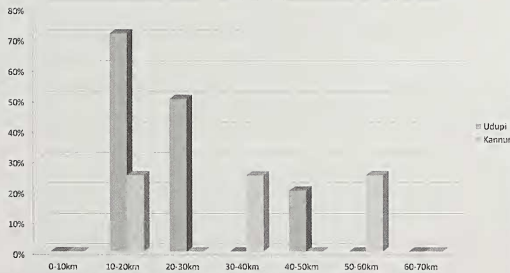


Fig. 6: Comparison of abundance of Parasitic Jaeger between Udupi and Kannur

In order to understand how the species are distributed across our coast, the occurrence data between the Kannur and Udupi trips was compared. Three sample species from different groups, which were relatively common in both the surveys, were taken for the comparison (Figs 4, 5, 6).

From the above comparisons, it is interesting to note that the distribution of Bridled Tern and Wilson's Storm Petrel are similar across Udupi and Kannur. On the other hand, the distribution of Parasitic Jaeger between the two places is not similar. This may be due to the fact that Parasitic Jaegers are large, nomadic, and kleptoparasitic, and hence may wander huge distances based on availability of food and concentration of other bird species on which they depend.

DISCUSSION

The present study revealed the presence of a good number of marine birds in the off-shore waters of the west coast. Many of the bird sightings were near the coast (within 20 km), indicating that the birds may not be difficult to find once one ventures further into the sea.

Trends in Distribution

Comparison of wind-blown records with offshore records (Fig. 2) clearly indicates the need for intensive pelagic exploration to understand the status of our seabirds.

Across the distance bands, at least two species showed strong affinity to the distance from the coast which is indirectly related to the depth of the sea bed. Wilson's Storm-Petrel was particularly numerous after a distance of 40 km from the coast in September and October. Jouanin's Petrel sightings during

September 2011 were at a distance of more than 80 km from the coast. The distance of the continental slope on the south-west Indian coast varies between 60 and 90 km – where the depth plunges from a mere 200 m to 1,000 m within a distance of 30 km. These regions have been traditionally associated with high productivity and frequent upwelling (Garcia *et al.* 2007; Ingle and Koslow 2005; Mossop 2007) – hence we should expect high density of seabirds in this region. Due to limitations of the boat, our surveys were not sufficiently geared to cover these distances.

Migration

The study also gave a fair understanding on the migratory patterns of our common pelagic birds – indicating the presence of breeding residents, boreal breeders that are winter visitors, austral breeders that are summer visitors, and passage migrants. Bridled Terns were present throughout the year and are probably residents from the breeding colonies known from Pittie Island in Lakshadweep (Pande *et al.* 2007) – prior to the survey, it was believed that the birds were mainly seen during autumn passage in SW India (Rasmussen and Anderton 2005). Sooty Terns are monsoon visitors to our seas occurring between May–September and this also concurs with the large number of wind-blown records during this period. Flesh-footed Shearwaters and Wilson's Storm-Petrels are summer visitors, peaking in numbers during the monsoon – in line with current knowledge that they spend only the austral summer in Indian Ocean. On the contrary, Persian Shearwaters are found only during spring passage (March–April) to the Persian Gulf where they breed (Rasmussen and Anderton 2005). Parasitic Jaeger and probably Pomarine Jaeger too are mainly winter visitors seen mostly between September–April and migrate north in summer. Movements of Swinhoe's Storm-Petrel are unclear at the moment – most records have been during autumn passage (September–October) with single birds seen during July and March.

Threats

The study is too short to assess any threats to the seabird species recorded. Elsewhere, longline fishing has been attributed as the cause of death of several seabirds (Brothers *et al.* 2010), the majority of them being Albatross (Family Diomedidae). In March 2012, a Pomarine Jaeger was photographed with a longline fishing thread hanging from its beak – the bird probably gorged on the bait which got stuck in its throat. In April 2011, a Persian Shearwater was photographed with a fishing net entangled in its legs, and the bird struggling to fly. These observations indicate that our seabirds could also be facing the same threats documented

elsewhere and a more careful monitoring on the fishing practices, by-catch and mortalities has to be conducted to design our fisheries to be less intrusive to the marine ecosystem.

Conservation and Marine IBAs

Bombay Natural History Society (BNHS) has started identifying important marine regions as Important Bird Areas (Kasambe 2011) and the current data indicate that there are several regions in the south-west coast of India that qualify as pelagic assemblages. However, most seabirds are not sedentary but free-ranging, hence it would be tough to identify a specific focus area to demarcate as an IBA.

CONCLUSIONS

This is the first study to examine seabird assemblages along a latitudinal gradient extending from Udupi in Karnataka to Kochi in Kerala along a distance of c. 400 km along the south-west coast of India. This study indicates that the calculation of distribution and abundance based on wind-blown specimens may not be completely accurate and bird surveys similar to the current study are necessary to get more accurate information. This study also indicates that the density of seabirds across months is not uniform, hence the necessity of studies covering the whole year. Ocean conditions are dynamic and change from year to year, particularly in the wake of climate change (Jennings and Brander 2010) and it is essential that we place our observation in a larger oceanographic context covering all the seasons. Thus, additional surveys are required to assess how the marine communities of the west coast of the Arabian Sea shift spatially and temporally. The study also demonstrates a simple proven methodology for seabird surveys, which can generate data for comparative studies in future.

The results of the present study indicate that regardless of the survey method employed, studies that use a band method, and that are designed to obtain accurate estimates of seabird abundance, require multiple observer teams using two or more observers on watch simultaneously with at least one person taking photographs for confirmation.

As the national research institutes like Fisheries Survey of India (FSI), National Institute of Oceanography (NIO), Central Marine Fish Research Institute (CMFRI) and Zoological Survey of India (ZSI) are already exploring the seas in various ways with their own vessels and facilities, collaborative pelagic expeditions with these institutes may reveal many interesting results on marine ornithology.

In addition to the practical difficulty of the availability and cost of boats, a major impediment to such studies is the lack of expertise among birders on marine birds. So it is also suggested that the birding networks covering the western coast should emphasis study of seabirds to build this expertise.

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